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ABSTRACT

This module is one of five modules on length, area, volume and capacity, mass, and temperature, developed for the use of teachers and teacher-trainer team leaders. Primary and intermediate activities in this booklet concentrate on the concept of area with emphasis on metric measurement. The objectives and needed materials for each activity are listed. (MN)

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PROJECT:

"METRIC EDUCATION: WE ARE GETTING READY FOR THE CHANGE"

MODULE ON AREA

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1977

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INTRODUCTION

This module on area is one of the five modules, on length, area, volume and capacity, mass, and temperature, developed, for the use of teachers and teacher-trainer team leaders, as a product from the Project "Metric Education: We Are Getting Ready For The Change."

Parts of this module were developed and tried during the recent workshops conducted for the BOCES level team leaders. Participants of these workshops made a significant contribution in the development of this module.

The activities incorporated in this module are only suggestive in nature and teachers are free to modify them according to their classroom needs.

Piyush C. Agrawal
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December 1977

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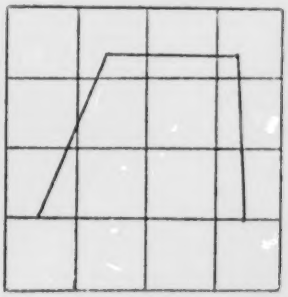
SECTION 1

P R I M A R Y

OBJECTIVE 1: Select objects of greater or lesser area by sight.

MATERIALS: At least 25 cards made up to show different size areas on a square centimeter background.

EXAMPLE:



ACTIVITY:

1. Cards divided between 2 players.
2. Each player turns over his top card.
3. Card figure with most area "takes" both cards.
4. If tie, players each turn over one more card. High card takes all four cards.
5. Winner is player with most cards at end of game.

VARIATION: Player wins who has least area.

* * *

OBJECTIVE 2: Express the area of a region using an unconventional unit.

MATERIALS: Beans, 5 large shapes cut from cardboard or plywood, one for each group of identical size.

ACTIVITY: Students break up into groups. Each group is provided with a quantity of beans and 5 numbered shapes. Each group covers each region with beans and records the number. Teacher or student volunteer records answers on chalk board. Teacher then discusses the need for a standard unit of measure.

OBJECTIVE 3: To compare the sizes of two dimensional objects with the same shape to determine which is larger, (smaller).

MATERIALS: Flannel board, two circular felt cutouts of the same size, two square felt cutouts of different sizes, worksheet with a number of shapes (one larger, one smaller).

ACTIVITY: Display two circular cutouts of the same size. Ask if one is as large as the other. Place one on top of the other and then excnahge the positions. Since neither shape extends beyond the other, say they have the same area.

Display two square cutouts of different sizes. Ask which is larger and which is smaller. Place one cutout on top of the other. If it extends beyond, say it is larger. If it does not, say it is smaller.

Let children look at worksheet. Have them circle the larger object and put an X through its smaller match.

* * *

OBJECTIVE 4: Enable a student to determine the larger of two plane objects.

MATERIALS: A collection of two-dimensional objects, posters, magazine covers, etc.

ACTIVITY: Student will select two objects from the collection and "guess" which is larger. The student will then cut the apparently larger object into pieces in an attempt to cover the other object. If the student has material left after the object is covered, then the guess was correct.

* * *

OBJECTIVE 5: To provide practice in finding surface area.

MATERIALS: Cans, bottles, boxes, containers, centimeter square grid paper, string, macaroni, beans.

ACTIVITY:

1. Students should work in groups of 6.
2. Give each group one box, one bottle, and one can.
3. Students within the group should work in pairs.
4. Each pair should try to use material at hand to find the surface area of the container.
5. See what techniques the students develop.

An Example Might Be: Glue beans to the entire surface of a bottle. Then count the beans. Place the same number of beans, close together, on grid paper. Then count the number of square centimeters of grid paper covered by the beans.

OBJECTIVE 6: To provide practice in using terms: in, out, and on.

MATERIALS: Duplicated pages with squares drawn on it, four crayons per student (red, blue, yellow, and green)

ACTIVITY:

1. To clarify concepts concerning a square, ask questions about the square to direct the children's ideas. Example: How many sides does the square have? How many corners does the square have? Are all of the four sides about the same length? Is the square closed like a picture frame?

2. Using the duplicated pages, give these instructions: Color green each of the four lines that close to make the square. Put a yellow dot inside the square. Put a blue dot outside the square. Put a red dot on the square.

3. To further practice terms in, out, and on, find area for sufficient room to move about. Using a long piece of rope or masking tape, make a large square. Play a game "Go in and out the square." Have children walk around the square while you give directions to them about what to do. Typical directions might be: "Go in and out the square, go in and out the square, step on the square, go in and out the square, step on and you are out."

All plane figures may be introduced in a similar way.

* * *

OBJECTIVE 7: Express the area of a region using a square unit of measure.

MATERIALS: 5 shapes from previous lesson. A square to be used as a unit of measure, preferably not a cm^2 or in^2.

ACTIVITY: The same as the previous lesson.

EXTRA ACTIVITY: Students may estimate the area of common objects such as books, magazines, windows, etc. Then they can measure these areas and compare the measurements with their estimates.

OBJECTIVE 8: Express the area of a region using a supplied unit area.

MATERIALS: Pencil, one centimeter square graph paper.

ACTIVITY:

1. Place you hand with fingers close together on the graph paper.
2. Estimate the area of your hand.
3. With your pencil, draw around your hand.
4. Place your hand with fingers spread apart on the graph paper.
5. Estimate the area of your hand.
6. With your pencil, draw around your hand.
7. Compare your two estimates. Should they be about the same.
8. Find the area of both hands.

* * *

SECTION 2

I N T E R M E D I A T E

OBJECTIVE 1: To measure areas using a cm^2 unit.

MATERIALS: Cardboard regions, ditto of rectangles, cm^2 unit.

ACTIVITY:
1. Have students break up into groups and use their cm^2 unit to measure the area of the cardboard regions. Compare measurements to be sure that all students know how to measure with the cm^2 unit.

2. Pass out dittos and have students estimate the areas of the rectangles. Then have students measure the areas and compare their measurements with their estimates.

* * *

OBJECTIVE 2: (a) To review using the cm^2 unit to measure area.

(b) To introduce the dm^2 unit to measure area.

MATERIALS: cm^2 unit, scissors, ditto.

ACTIVITY:
1. Students will measure 3 rectangles on the ditto with their cm^2 unit and record the areas.

2. Students will cut out the dm^2 unit and measure the objects listed on the ditto.

EXTRA ACTIVITY: Students can suggest additional items to measure.

* * *

OBJECTIVE 3: To discover the conversion fact $100\ cm^2 = 1\ dm^2$.
To convert measurements from dm^2 to cm^2.

MATERIALS: cm^2 unit, dm^2 unit, 30 cm ruler

ACTIVITY: Students will use the ruler to mark off the edges of their dm^2 in cm. They will then draw lines parallel to the edges at 1 cm. intervals thus forming a 10 cm x 10 cm grid. Students will then compare the smaller squares with their cm^2 unit. Students will then convert the areas from the previous lesson to cm^2.

OBJECTIVE 4: To select the proper unit of area measure to express the area of a given region.

MATERIALS: Ditto

ACTIVITY: Students will select proper unit from list of 5 units of area measure. Teacher will then discuss the students reasons for best selections. Choose the best unit to measure the area of each.

(a) cm^2 (b) m^2 (c) mm^2 (d) km^2 (e) are

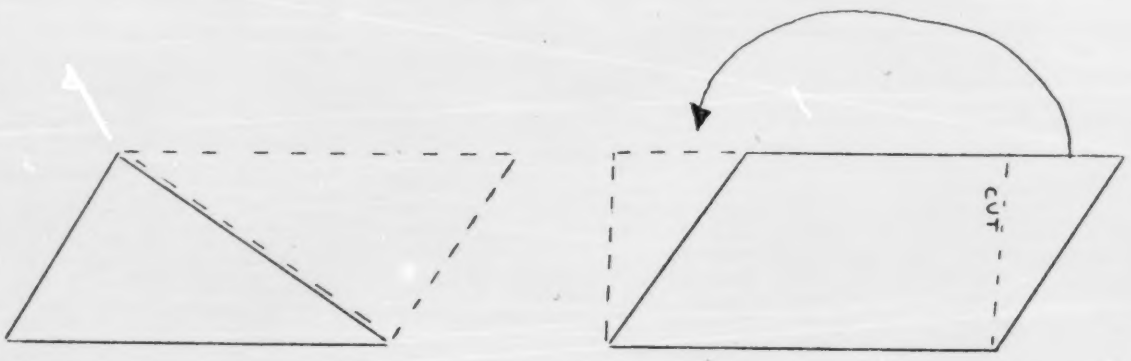
1. a postage stamp
2. the football field
3. your desk top
4. the state of Pennsylvania
5. the door of this classroom
6. your thumbnail
7. a garden
8. the cafeteria floor
9. an index card
10. a magazine cover

* * *

OBJECTIVE 5: Develop student awareness that the area of any triangle is one-half of the area of a rectangle with the same base and the same altitude.

MATERIALS: A variety of triangles cut out with the measures of the base and altitude in whole centimeters. Graph paper with square centimeter rulings or a measuring device.

ACTIVITY: Student will select a pre-cut triangle, trace around it on sturdy paper and cut out the duplicate. Placing two edges together a parallelogram will be formed. Appropriately cutting one end of the parallelogram off and placing it at the other end will form a rectangle. The area of the rectangle can be determined by placing it on graph paper and counting the squares or by measuring the base and altitude and using A=BH. The area of the triangle must be $A=\frac{1}{2}BH$.



OBJECTIVE 6: To make up problems concerning area to draw sketches of some real or imagined areas.

MATERIAL: Paper, pencil, ruler

ACTIVITY:

1. Introduce activity by bringing out idea that roofing, painting, wallpapering, among others requires the computation of areas.
2. Ask pupils to make sketches of some real or imagined surfaces.
3. Then have them assign the necessary dimensions.
4. Have students find the area and then challenge the other members in the class to determine these areas.
5. The teacher should note the complexity of these problems and should select several sketches for class study. These selected illustrations should be placed on the board.
6. The class should compute the areas of the figures in a time predetermined by the teacher.
7. At the end of that time, ask for volunteers to put their solutions on the chalkboard.
8. Check correctness of interpretation and computation first with the class and later with pupil who originated the problem.

* * *

OBJECTIVE 7: To provide practice in estimating areas.

MATERIALS: Objects common to classroom.

ACTIVITY:

1. Have students use estimation to find at least one object with a flat surface in the classroom whose area approximately corresponds to the following areas:

   $8\ cm^2$ $3\ m^2$

   $1\ dm^2$ $80\ cm^2$

2. After finding objects which approximate the areas, measure the actual area.
3. Compare estimates to actual area.

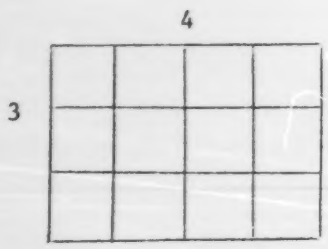
OBJECTIVE 8: To show the difference between area and perimeter.

MATERIALS: Squared material or geoboard.

ACTIVITY:

1. Have students choose a specific number of squares to serve as their constant area.
2. Using each of the squares, pupil should build as many different rectangular arrays as possible.
3. Pupils should then record findings and make comparisons.
4. Possible questions: Which rectangle has greatest perimeter? Smallest perimeter?

Example:



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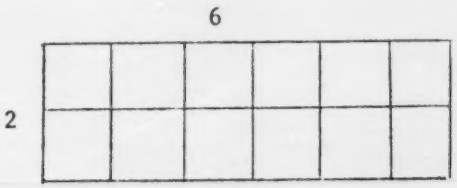

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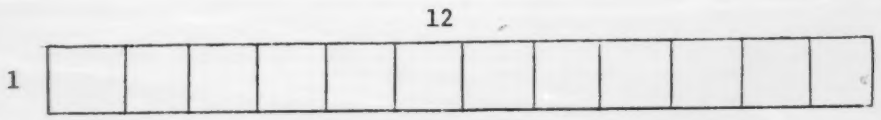

P = 26

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OBJECTIVE 9: Draw a figure of a specified area.

MATERIALS: Pencil, sheet of centimeter square graph paper for each student, one each of the following cards.

1 sq cm	1.5 sq cm	2 sq cm	2.5 sq cm	15 sq cm

ACTIVITY:

1. Each player outlines a 15 sq. cm by 30 sq. cm rectangle on his paper.
2. Cards are mixed and placed face down.
3. Players to left turns over top card and shades on his paper the area that's indicated on the card. Next player turns over a card and shades in the area designated.
4. Play continues until a player has shaded in all of his rectangle.
5. First player to do so wins the game.
6. If all cards are used, reshuffle, turn over and continue to play.

* * *

OBJECTIVE 10: To make a figure of a specified area.

MATERIALS: A sheet of square centimeter graph paper for each student, scissors for each student.

ACTIVITY:

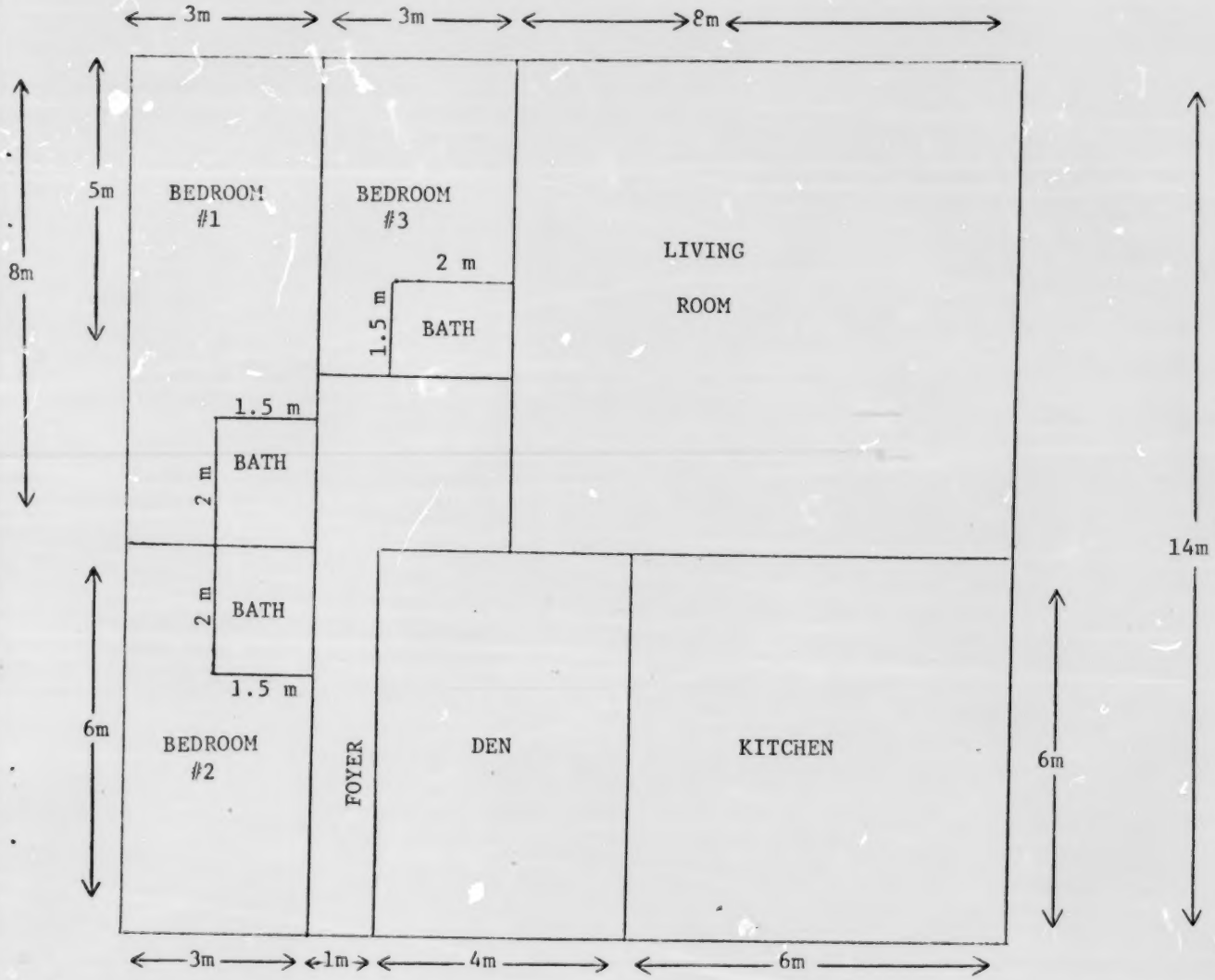
1. Divide class into teams of 10 persons.
2. Each student is to cut out an area of 10 square centimeters without knowing what shapes his team mates are cutting.
3. When all have cut out their shapes, call out "go".
4. Each teams tries to form a rectangle or square using it's ten shapes.
5. The area of the resulting figure should be 100 square centimeters or one square decimeter.

OBJECTIVE 11: To provide practice in reading floor plan and scales to interpret floor plan in solving problems.

MATERIAL: Copy of floor plan.

ACTIVITY: 1. Floor plan drawn on a scale of 1 cm = 1 m

2. Using information provided, answer questions.



1. What is the area including bathroom or Bedroom #1? _____

2. How many square meters of carpet will be needed for the bedroom? _____
You will not carpet the bathroom.

3. What is the area of Bedroom #2?_____

4. How many square meters of carpet will be needed for this room? You will not carpet the bathroom. _____

5. What is the area of the living room?_____

6. What is the area of the kitchen?_____

7. What is the area of the den?_____

8. What is the area of the three bedrooms?_____

9. What is the total area of the floor plan?_____